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PARKING MANAGEMENT SYSTEM

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(57) Claim

1. A real time parking management system for a parking resource comprising a central control station comprising data processing means and data communication interface means connected to the data processing means; and a plurality of electronic parking meters each associated with at least one parking bay and each comprising an electronic operation controller means, a memory arrangement and data communication interface means, both connected to said controller means; the data communication interface means of the control station being connected to the data communication interface means of each of said plurality of parking meters via a data communication path; the data communication interface means and data communication path enabling real time communication of data from said parking meters to said data processing means for processing in real time, thereby to facilitate management of the parking resource.

## INTRODUCTION AND BACKGROUND

THIS invention relates to management systems and more particularly to a system for managing parking.

Electronic parking meters are known in the art. However, the known meters are mostly used as stand alone units for measuring a time interval for which a user paid to park in a demarcated parking bay and to indicate whether there is still part of a period paid for available or whether the period has expired. However, in one known system the meters are connected by communication lines to a central control station so that historical data regarding the amount of cash received via each meter may from time to time be transmitted via the lines to be stored in a memory arrangement associated with the control station, for subsequent cash collection control purposes only.

However, control over cash collection is but one aspect of effective and efficient parking management. Effective parking management entails effective cash collection control, control over the technology employed and control over the utilisation by users, of the parking resource.

### OBJECT OF THE INVENTION

Accordingly it is an object of the present invention to provide a system and method with which the applicant believes more effective management of available parking may be achieved.

### SUMMARY OF THE INVENTION

According to the invention where is provided a real time parking management system for a parking resource the management system comprising: a central control station comprising data processing means and data communication interface means connected to the data processing means; and a plurality of electronic parking meters each associated with at least one parking bay and each comprising an electronic operation controller means, a memory arrangement and data communication interface means, both connected to said controller means; the data communication interface means of the control station being connected to the data communication interface means of each of said plurality of parking meters via a data communication path; the data communication

interface means and data communication path enabling real time communication of data from said parking meters to said data processing means for processing said data in real time, thereby to facilitate management of the parking resource.

Each of said plurality of parking meters may comprise means for detecting the presence of a vehicle in said at least one parking bay.

The means for detecting the presence of a vehicle preferably comprises an inductive detection loop connected to the operation controller means. The detection loop may extend in a road surface into said at least one parking bay.

Said data communication path may comprise a parking meter communication system comprising a conductive communication loop wherein said plurality of parking meters are connected.

The conductive communication loop may comprise a plurality of spaced junction circuits. Each of said plurality of junction circuits is connected to a

different one of said plurality of parking meters via the data communication interface of that parking meter.

The data communication interface of each of said plurality of parking meters preferably comprises repeater means bypassing the operation controller means of the parking meter.

The operation controller means of each of said plurality of parking meters may be connected to the data communication interface of that parking meter via a data input line and a data output line and the repeater means may comprise an OR- gate having first and second inputs and an output, the first input being connected to the data input line, the second input to the data output line and the output being connected to the junction circuit.

The data communication system may comprise a branching device having an input and at least one output, the input being connected to the data communication interface of the control station and the at least one output, to ends of said conductive communication loop.

The input of the branching device may be connected to the data communication interface of the control station via dedicated data lines extending between a first and a second modem, the first modem being connected to the data communication interface of the control station and the second modem being connected to the input of the branching device.

The input of the branching device may alternatively be connectable to the data communication interface of the control station via a public telephone network, the public telephone network being connected between a first modem connected to the data communication interface of the control station and a second dial up modem connected to the input of the branching device.

The input of the branching device may also be connectable to the data communication interface of the control station via a public switched network connected between a first modem connected to the data communication interface of the control station and a second dial up modem connected to a concentrator which in turn is connected to the input of the branching device.

The parking management system may further comprise a transportable milking device which, in use, is connectable to a selected one of said plurality of parking meters for retrieving data stored in the memory arrangement of said selected one of said plurality of parking meters, the milking device also being connectable to the data processing means of the control station, for down loading the retrieved data.

Furthermore, the parking management system may also comprise a transportable field programming device, the field programming device being connectable to the data processing means of the control station to receive data to be loaded into a selected one of said plurality of parking meters, the field programming device also being connectable to said selected one of said plurality of parking meters to load the data into the memory arrangement of said selected one of said plurality of parking meters.

Each of said plurality of parking meters may comprise one or more of the following: means for sensing when a cash box is located in the parking meter; means for sensing when a first door of the parking meter



providing access to the cash box is open; and means for sensing when a second door providing access to electronic circuitry of the parking meter is open.

The memory arrangement of each of said plurality of parking meters preferably comprises memory means for storing parking meter configuration data. The parking meter configuration data stored in said memory means may selectively be changed by the control station via said data communication path.

Each of said plurality of parking meters may comprise means for performing diagnostic tests on the parking meter. The memory arrangement of each of said plurality of parking meters may comprise fault condition flags and fault occurrence counting means for storing data relating to detected fault conditions. The data relating to detected fault conditions is transmitted to the control station via said data communication path.

Each of said plurality of parking meters preferably comprises an electronic token validator. The memory arrangement of each of said plurality of parking

meters comprises operational data memory means for storing operational data regarding the number and value of tokens received. The operational data is transmitted to the control station via said data communication path.

Each of said plurality of parking meters may comprise a real time clock. The operation controller means and real time clock of each of said plurality of parking meters being adapted to allocate time data to predetermined events and to store said time data and data relating to the kind of event in the memory means.

The control station may comprise data output means connected to the data processor, for providing reports in real time based on the processing of the data received from said plurality of parking meters.

Also included within the scope of the present invention is a method of managing a parking resource comprising a plurality of demarcated parking bays, the method comprising the steps of providing electronic parking meters to monitor utilisation of

the bays; connecting the electronic parking meters via a data communication path to a central control station; causing the parking meters continually to perform self diagnostic tests and to gather data relating to results of the tests; causing the parking meters continually to gather operational data relating to funds received by the parking meter; causing the parking meters to transmit the data relating to the self diagnostic tests or the operational data to the control station in real time; and at the control station processing said data in real time and producing results based on the data processed.

Further according to this aspect of the invention, parking meter configuration data stored in said parking meters may from time to time be updated by transmitting new configuration data from the control station to at least some of said parking meters via said data communication path.

The method may also include the step of causing each parking meter continually to sense whether a vehicle is parked in a bay monitored by the parking meter and

transmitting data relating to occupation of the bay to the control station in real time.

#### BRIEF DESCRIPTION OF THE ACCOMPANYING DIAGRAMS

The invention will now further be described, by way of example only, with reference to the accompanying diagrams wherein:

figure 1 is a block diagram of a parking management system according to the invention;

figure 2 is a block diagram of a parking meter communication system forming part of the management system according to the invention;

figure 3 is a block diagram of electronic circuitry forming part of an electronic parking meter and its connection to the communication system;

figure 4 is a perspective view of a closed housing for an electronic parking meter forming part of the management system according to the invention;

figure 5 is a perspective view of the housing with two doors thereof in an open condition; and

figure 6 is a perspective view of a mounting pole

for an electronic parking meter forming part of the system according to the invention, also showing underground ducting for data communication lines.

#### DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

A parking management system according to the invention is generally designated by the reference numeral 10 in figure 1.

The system 10 comprises a plurality of electronic parking meters 12 (shown in figures 3 to 5) connected to a central control station 14 via data communication paths comprising data communication lines 16. The central control station 14 comprises a data processor 18, and a data communication interface 20. As best shown in figures 2 and 3, each parking meter 12 is associated with four parking bays 22.1 to 22.4. Means for detecting the presence of a vehicle in a bay in the form of inductive loops 24.1 to 24.4 are connected to operation controller means 26 of the parking meter 12. The loop is located just below the road surface in the bay.

The parking meters 12 are inter-connected in parking meter communication systems 28.1 to 28.4, shown in figure 1. Since these systems are similar, only data communication system 28.1 will be described hereinafter.

Parking meter communication system 28.1 comprises a branching device 30 having a main input port 30.1 connected to the remainder of the management system and a plurality of output or branch ports 30.2 and 30.3, cascaded together. To each of the branch ports there is connected a data communication loop 32 comprising a plurality of junction circuits 34 and to each junction circuit 34 there is connected one of the electronic parking meters 12, via a data communication interface 36 comprising a repeater circuit 38, shown in figure 3. The repeater circuit 38 serves to enhance the integrity of signals transmitted from one parking meter 12 to an immediately adjacent meter in the loop.

The repeater circuit 38 comprises an OR-gate 40 one input of which is connected to a data input line from the junction circuit 34 which is also connected to an

input of the controller 26. The other input of the OR-gate is connected to a data output line from the controller 26. The output of the OR-gate 40 is connected to a buffer 42, an output of which is connected to a return line connected to the junction circuit 34. Thus, should a parking meter connected to the loop become unserviceable, data will still ripple through the circuit 38 of that meter to the adjacent parking meter and to the branching device 30.

As shown in figure 6, there is provided a tubular mounting pole 37 for each parking meter, to facilitate connection to loop 32. The pole is planted in the ground and underground ducting 39 for loop 32 is provided. A power supply (not shown) may also be connected to the branching device 30 and power may similarly be distributed to the parking meters via power cables (not shown).

As best shown in figures 4 and 5, each parking meter 12 comprises a housing 44 having a top door 46 and a bottom door 48. The top door 46 provides access to a compartment wherein the electronic circuitry (which

will be described in more detail hereinafter with reference to figure 3) of the parking meter is housed and the bottom door 48 to a compartment for removably receiving a cash box 50.

As best shown in figure 3, each parking meter comprises an electronic operation controller 26, a keypad 54 and a display 56 connected to the controller 26. The keypad and display are also shown in figure 4.

Sensor means 58, 60 for determining whether the aforementioned top door 46 and the bottom door 48 respectively are open, are electronically connected to the controller 26. A sensor 62 for determining whether the cash box 50 is in position is also provided in the bottom compartment and is connected electronically to the controller 26. Temperature sensitive means 64 and a timer 65 comprising a real time clock 66 are further electronically connected to the controller 26. The parking meter 12 further comprises an electronic token validator 68 (also shown in figure 5) connected to the controller 26. The validator, in use, determines the denomination of



coins received through the coin slot 70 (also shown in figure 4) and channeled to the cash box 50.

The memory arrangement 72 connected to the controller 26 comprises a region 72.1 for storing program data controlling operation of the meter, a region 72.2 for storing configuration data, a region 72.3 comprising fault condition flags and counters and a region 72.4 for storing operational data, such as total amount of cash in the cash box and the number of coins of each denomination in the cash box.

As shown in figure 1, one parking meter communication system 28.1 may be connected directly to the central control station 14 via lines 16. A second parking meter communication system 28.2 may be connected via dedicated lines 16.1, extending between modems 74, to the central control station 14. Another possibility is that a parking meter communication system 28.3 is connected to the central control station 14 via a modem 76, a public communication network 78 and a dial-up modem 80. Yet another possibility is that the central control station 14 is connected to the parking meter communication system 28.4 via a modem

82, a public switched network 84, a dial-up modem 86 and a concentrator 88.

Also forming part of the system according to the invention are a portable field programming device 90 and a portable so-called milking machine 96. the field programming device 90 comprises a controller including a suitable data communication interface 92 and a memory arrangement 94. The milking machine also comprises a controller including a suitable data interface 98 and a memory arrangement 100. Both these devices are connectable to be in data communication with a selected one of the data processor 18 of the control station and the operation controllers 26 of the meters 12.

The field programming device 90 is connectable to the data processor 18 of the control station to receive programme data and/or configuration data. Thereafter the device is connected to a controller 26 of a selected parking meter to load and store the data received in the memory arrangement 72 of the parking meter. The milking machine 96 has a unique identity code stored in its memory arrangement. When

connected to a controller 26 of a parking meter, it is interrogated for the code. If the code corresponds to a code stored in the memory arrangement of the parking meter, predetermined data is loaded from the parking meter into the milking machine. The data so received is loaded into the data processor 18 of the control station, by subsequently connecting the milking machine 96 to the data processor 18.

In use, the electronic parking meters 12 with their vehicle sensing inductive loops 24.1 to 24.4 are in real time data communication with the central control station 14 via data lines 16. Data regarding the operation and status of each parking meter 12 may thus be communicated to the central control station for processing and control in real time.

Such data may include data indicative of whether a bay 22 is vacant or whether a vehicle is parked in the bay as sensed by the loops in well known manner, data relating to the amount of cash received by the parking meter during a specified time period or the total amount of cash in cash box 50, data relating to

the results of diagnostic tests on the parking meter and data indicative of a situation wherein a vehicle is parked in the bay during a time period not paid for.

Effective parking management entails effective cash collection control, control over the parking resource and control over the technology employed. The system according to the invention enables gathering of data relating to each of these three aspects in real time, thereby to facilitate parking management.

Control over technology is achieved in that the results of diagnostic tests performed on the individual parking meters 12, whether automatically initiated or via the field programming device 90 or directly from the control station 14, are compiled in memory region 72.3 and transmitted via the communication systems 28.1 to 28.4 and lines 16 to the central control station 14. Reports may be prepared at the control station 14 or other centralised venue to assist technicians in the maintenance of the meters 12. Memory region 72.3 comprises a plurality of fault condition flags and

associated fault condition counters. Together with the real time clock 66, the Controller 26 allocates time stamps to fault conditions detected. The fault condition counters count the number of times different fault conditions are detected. All this data is then made available to the control station 14 as hereinbefore described.

Furthermore, configuration data such as data relating to token or coin characteristics, tariff changes, operating hours, number of bays to be controlled by a parking meter, displayable text to be displayed on display 56 for the benefit of users and technicians, special days to be catered for and identity codes may be compiled by means of a configuration editor program resident in the processor 18 at the control station 14 and sent via the communication lines 16 and loaded into the parking meters 12 to be stored in the configuration data region 72.2 of memory arrangement 72. It will be appreciated that with the real time clock 66, the parking meters may be configured to change on a specified day from an existing tariff table stored in region 72.2 to a new tariff table also stored in region 72.2.

Control over cash collection is achieved in that data regarding the total amount of cash received by each parking meter and stored in its cash box 50 is stored in region 72.4 of memory arrangement 72 and transmitted to the control station 14 where it is updated.

Another advantage of the system is that the controller 26 of each parking meter 12 is adapted, upon a signal from the vehicle detection loop 24, to reset the timer 65, every time a vehicle leaves the parking bay, thereby increasing revenue from the meter in that a next user will not be able to utilize unexpired time paid for by the previous user. In that data, indicative of a situation wherein a vehicle is parked in a bay 22 during a time period not paid for, is available in real time at the control station, this data may be printed out at regular intervals and may be used to direct law enforcement officers to such bays for further action.

Control over the parking resource is possible in that data relating to a distribution of vehicles over the parking resource as a whole is also available at the

control station 14 in real time. Accordingly, vehicles may be routed to areas where existing parking space is under utilised. Alternatively, the tariff for parking in more popular regions may be increased and that for under utilised regions may be decreased as hereinbefore described, to facilitate an even distribution of vehicles over the entire resource and thus to manage the parking more effectively.

All communications between the control station 14 and parking meters 12 take place over asynchronous serial communication lines 16, 32. The parking meters 12 act as slaves to the data processor 18 and do not send unsolicited data. A parking meter only transmits data in response to being individually polled by the data processor 18.

It will be appreciated that there are many variations in detail on the system according to the invention without departing from the scope and spirit of the appended claims.

**CLAIMS:**

1. A real time parking management system for a parking resource comprising a central control station comprising data processing means and data communication interface means connected to the data processing means; and a plurality of electronic parking meters each associated with at least one parking bay and each comprising an electronic operation controller means, a memory arrangement and data communication interface means, both connected to said controller means; the data communication interface means of the control station being connected to the data communication interface means of each of said plurality of parking meters via a data communication path; the data communication interface means and data communication path enabling real time communication of data from said parking meters to said data processing means for processing in real time, thereby to facilitate management of the parking resource.

2. A parking management system as claimed in claim 1 wherein each of said plurality of parking meters



comprises means for detecting the presence of a vehicle in said at least one parking bay.

3. A parking management system as claimed in claim 2 wherein the means for detecting the presence of a vehicle comprises an inductive detection loop connected to the operation controller means and which detection loop extends in a road surface into said at least one parking bay.

4. A parking management system as claimed in any one of the preceding claims wherein said data communication path comprises a parking meter communication system comprising a conductive communication loop wherein said plurality of parking meters are connected.

5. A parking management system as claimed in claim 4 wherein the conductive communication loop comprises a plurality of spaced junction circuits, each of said plurality of junction circuits being connected to a different one of said plurality of parking meters via the data communication interface of that parking meter.

6. A parking management system as claimed in claim 5 wherein the data communication interface of each of said plurality of parking meters comprises repeater means bypassing the operation controller means of the parking meter.

7. A parking management system as claimed in claim 6 wherein the operation controller means of each of said plurality of parking meters is connected to the data communication interface of that parking meter via a data input line and a data output line and wherein the repeater means comprises an OR-gate having first and second inputs and an output, the first input being connected to the data input line and the second input to the data output line, the output being connected to the junction circuit.

8. A parking management system as claimed in any one of claims 5 to 7 wherein the data communication system comprises a branching device having an input and at least one output, the input being connected to the data communication interface of the control station and the at least one output, to ends of said conductive communication loop.

9. A parking management system as claimed in claim 8 wherein the input of the branching device is connected to the data communication interface of the control station via dedicated data lines extending between a first and a second modem, the first modem being connected to the data communication interface of the control station and the second modem being connected to the input of the branching device.

10. A parking management system as claimed in claim 8 wherein the input of the branching device is connectable to the data communication interface of the control station via a public telephone network, the public telephone network being connected between a first modem connected to the data communication interface of the control station and a second dial up modem connected to the input of the branching device.

11. A parking management system as claimed in claim 8 wherein the input of the branching device is connectable to the data communication interface of the control station via a public switched network connected between a first modem connected to the data communication interface of the control station and a

second dial up modem connected to a concentrator which in turn is connected to the input of the branching device.

12. A parking management system as claimed in any one of the preceding claims comprising a transportable milking device which, in use, is connectable to a selected one of said plurality of parking meters for retrieving data stored in the memory arrangement of said selected one of said plurality of parking meters, the milking device also being connectable to the data processing means of the control station, for down loading the retrieved data.

13. A parking management system as claimed in any one of the preceding comprising a transportable field programming device, the field programming device being connectable to the data processing means of the control station to receive data to be loaded into a selected one of said plurality of parking meters, the field programming device also being connectable to said selected one of said plurality of parking meters to load the data into the memory arrangement of said selected one of said plurality of parking meters.

14. A parking management system as claimed in any one of claims 1 to 13 wherein each of said plurality of parking meters comprises one or more of the following: means for sensing when a cash box is located in the parking meter; means for sensing when a first door of the parking meter providing access to the cash box is open; and means for sensing when a second door providing access to electronic circuitry of the parking meter is open.

15. A parking management system as claimed in any one of the preceding claims wherein the memory arrangement of each of said plurality of parking meters comprises memory means for storing parking meter configuration data and wherein parking meter configuration data stored in said memory means may selectively be changed by the control station via said data communication path.

16. A parking management system as claimed in any one of the preceding claims wherein each of said plurality of parking meters comprises means for performing diagnostic tests on the parking meter, wherein the memory arrangement of each of said

plurality of parking meters comprises fault condition flags and fault occurrence counting means for storing data relating to detected fault conditions and wherein the data relating to detected fault conditions is transmitted to the control station via said data communication path.

17. A parking management system as claimed in any one of the preceding claims wherein each of said plurality of parking meters comprises an electronic token validator, and wherein the memory arrangement of each of said plurality of parking meters comprises operational data memory means for storing operational data regarding the number and value of tokens received and wherein the operational data is transmitted to the control station via said data communication path.

18. A parking management system as claimed in any one of the preceding claims wherein each of said plurality of parking meters comprises a real time clock, the operation controller means and real time clock of each of said plurality of parking meters being adapted to allocate time data to predetermined

events and to store said time data and data relating to the kind of event in the memory means.

19. A parking management system as claimed in any one of the preceding claims wherein the control station comprises data output means connected to the data processor, for providing reports in real time based on the processing of the data received from said plurality of parking meters.

20. A method of managing a parking resource comprising a plurality of demarcated parking bays, the method comprising the steps of providing electronic parking meters to monitor utilization of the bays; connecting the electronic parking meters via a data communication path to a central control station; causing the parking meters continually to perform self diagnostic tests and to gather data relating to results of the tests; causing the parking meters continually to gather operational data relating to funds received by the parking meter; causing the parking meters to transmit the data relating to the self diagnostic tests or the operational data to the control station in real time;

and at the control station processing said data in real time and producing results based on the data processed.

21. A method as claimed in claim 20 wherein parking meter configuration data stored in said parking meters is from time to time updated by transmitting new configuration data from the control station to at least some of said parking meters via said data communication path.

22. A method as claimed in claim 20 or claim 21 comprising the step of causing each parking meter continually to sense whether a vehicle is parked in a bay monitored by the parking meter and transmitting data relating to occupation of the bay to the control station in real time.

23. A parking management system substantially as herein described with reference to the accompanying diagrams.



24. A method of managing a parking resource substantially as herein described with reference to the accompanying diagrams.

25. The steps, features, compositions and compounds disclosed herein or referred to or indicated in the specification and/or claims of this application, individually or collectively, and any and all combinations of any two or more of said steps or features.

DATED this TWENTY SECOND day of SEPTEMBER 1993

Telkor (Proprietary) Limited

by DAVIES COLLISON CAVE  
Patent Attorneys for the applicant(s)

ABSTRACT

A real time parking management system for a parking resource is disclosed and claimed. The management system 10 comprises a central control station 14 comprising a data processor 18 and a data communication interface 20 connected to the data processor. A plurality of electronic parking meters 12 are connected to the central control station via a data path 16. Each parking meter being associated with at least one parking bay 22 and each comprising an electronic operation controller 26, a memory arrangement 72 and data communication interface 36, both connected to said controller. The data communication interfaces 20 and 36 and data communication path 16 enabling real time communication of operational and fault condition data from said parking meters 12 to said data processor 18 for processing said data in real time, thereby to facilitate management of the parking resource.

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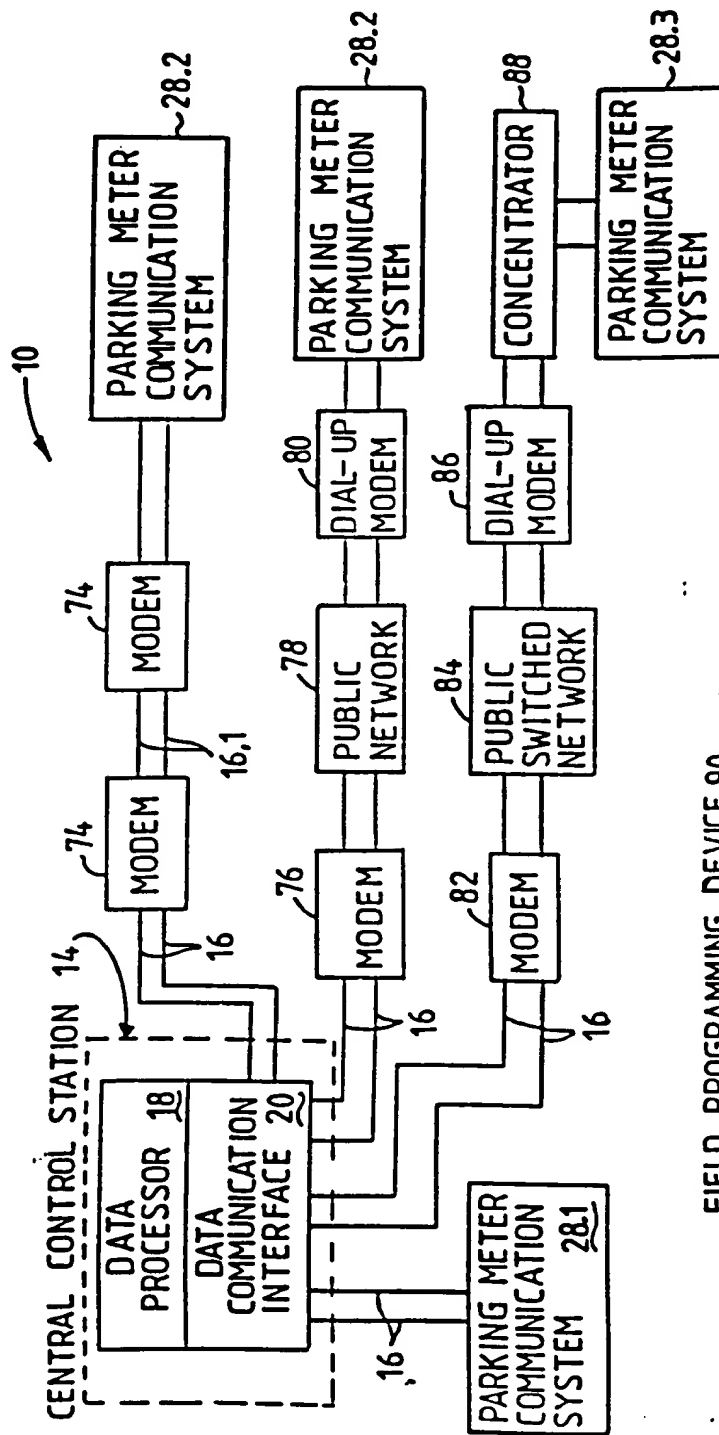
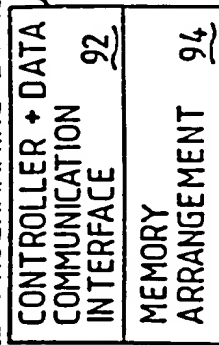
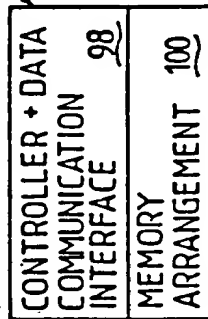


FIGURE 1

FIELD PROGRAMMING DEVICE 90



MILKING MACHINE 96



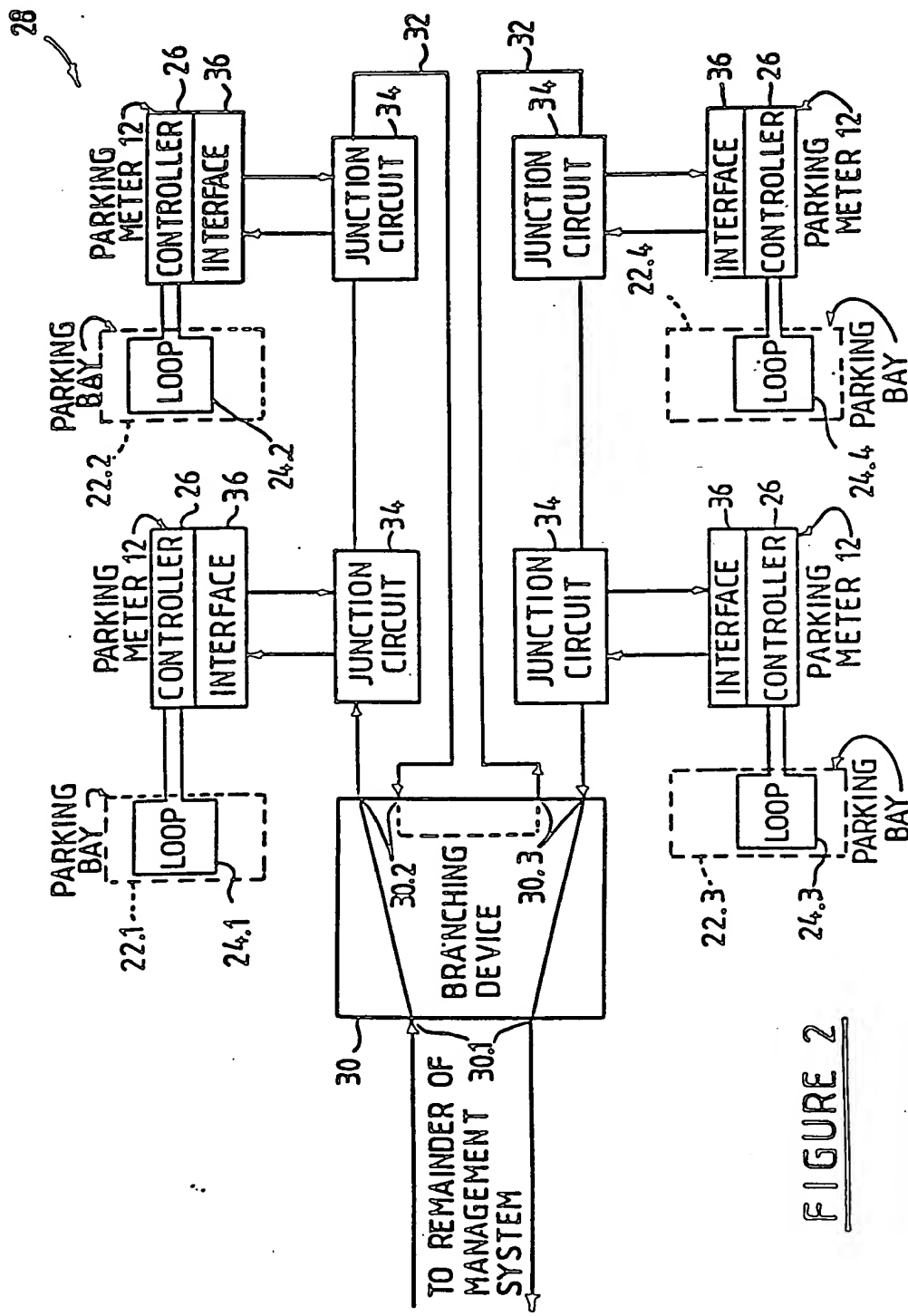


FIGURE 2

2024 000000

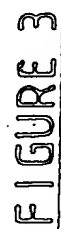


FIGURE 3

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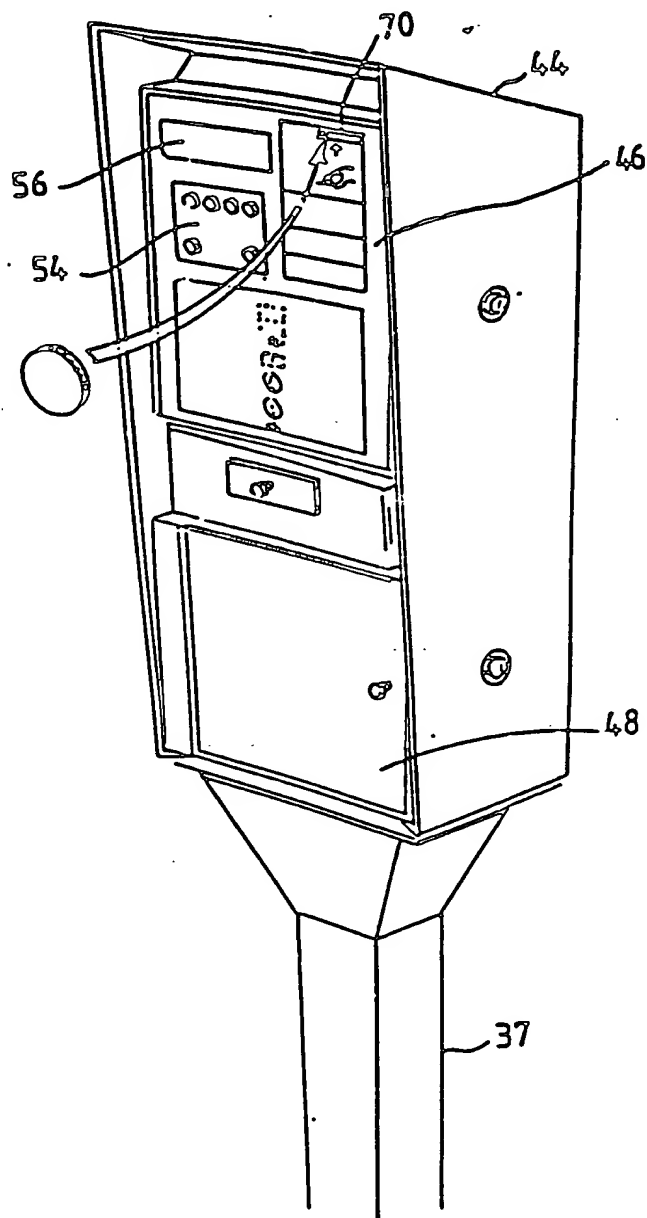
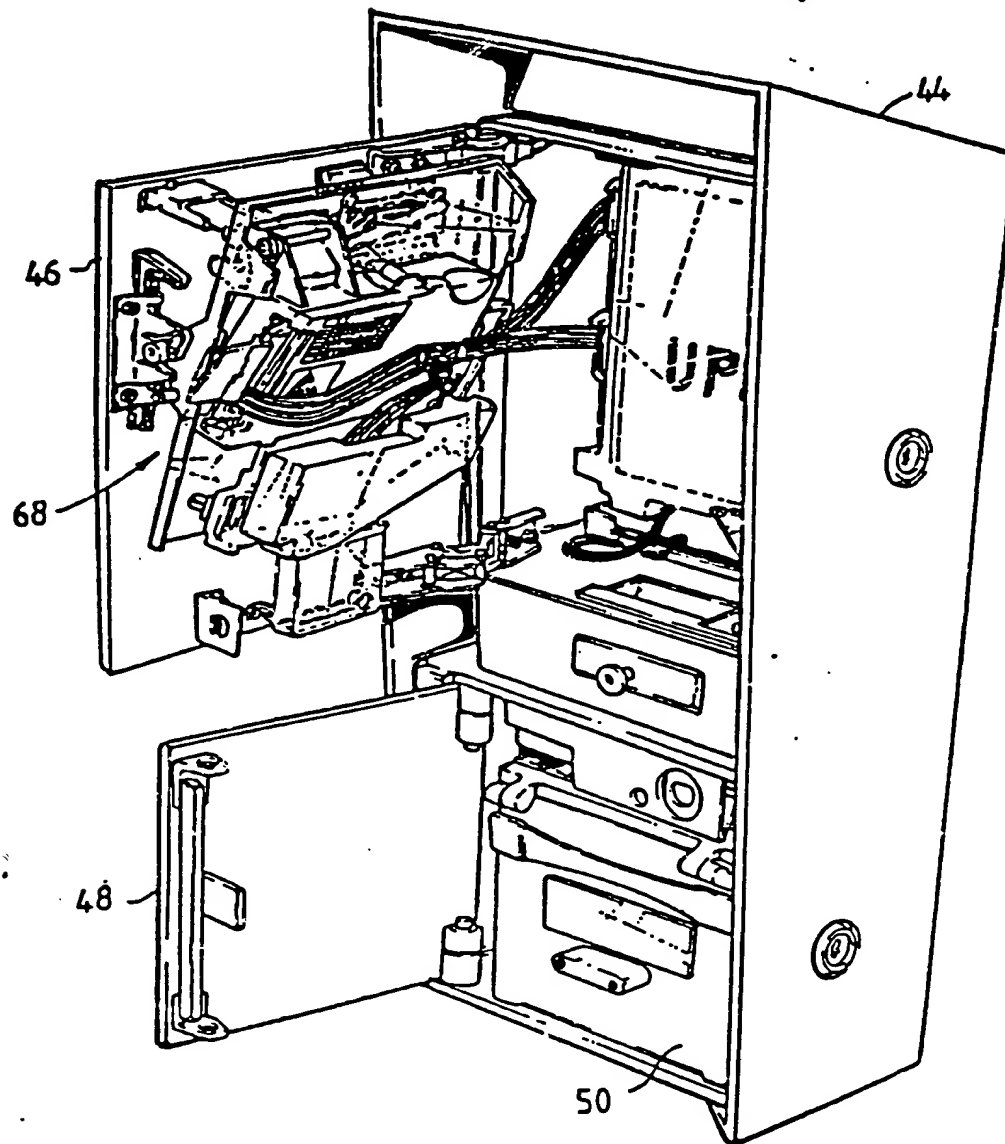


FIGURE 4

FIGURE 5

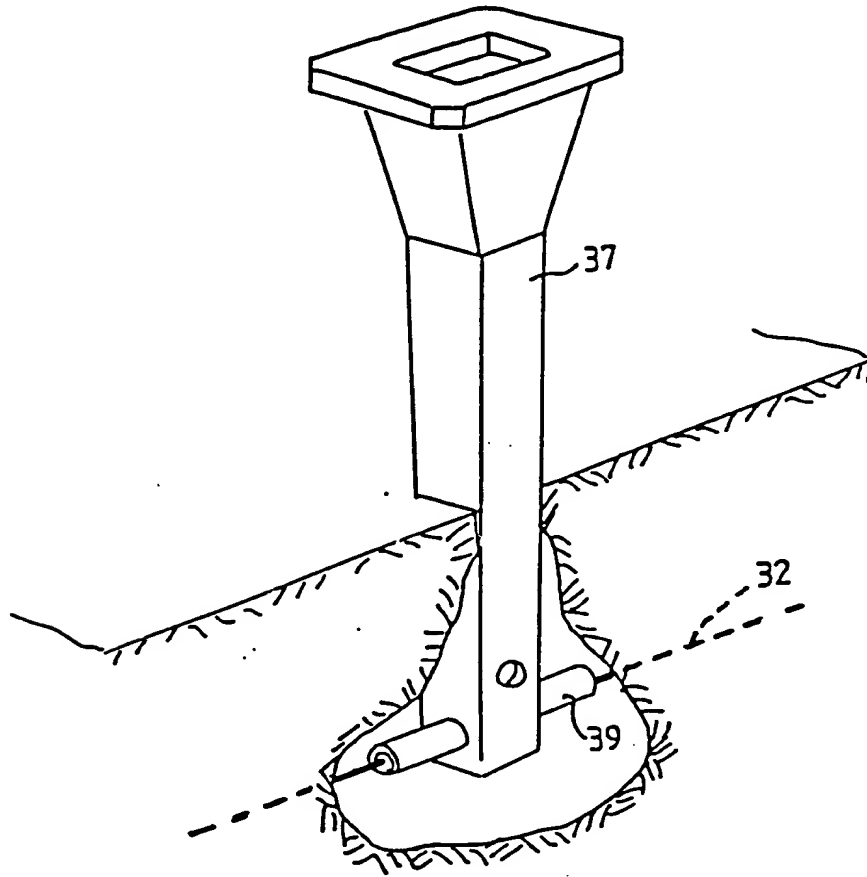


FIGURE 6